SPERRY *Microline*

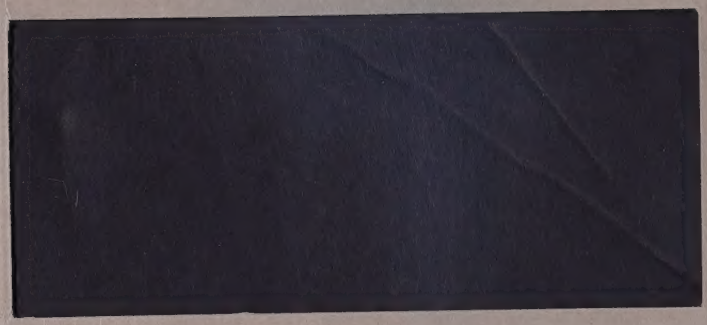
COAXIAL DIRECTIONAL COUPLER

Model 480-20 Ser. #71

960 - 1,990 Mc

PROPERTY OF ENGINEERING
TEST CONSTRUCTION
ITEM 8 COPY 1
48 HOUR LOAN

SPERRY GYROSCOPE COMPANY
DIVISION OF THE SPERRY CORPORATION
GREAT NECK, NEW YORK



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OPERATING INSTRUCTIONS
AND TECHNICAL DATA

Microline®

COAXIAL DIRECTIONAL COUPLERS

MODELS
467, 480, 517 & 519
240 to 4,000 MC

These Coaxial Directional Couplers are of the compensated axial-slot type. The set of four models is fabricated to the same basic design in RG-92/U (standard 7/8-inch coaxial) transmission line. They provide a satisfactory and convenient means for monitoring microwave power in mating coaxial lines.

Each instrument in the group operates over a two-to-one frequency range with an unusually uniform coupling characteristic which varies less than two decibels per octave of frequency. The effective directivity is greater than 15 decibels. Each model is available in nominal coupling values of 20, 30 and 40 decibels. Because of the rugged, fixed-tuned construction built into these instruments, the calibration stability inherent in this type of coupler will remain constant under all conditions of normal use. Temperature and humidity effects are negligible.

The overall frequency range of the group permits continuous coverage for use at all signal frequencies from 240 to 4,000 megacycles per second (mc).

APPLICATIONS

Microline coaxial directional couplers are versatile, precision instruments well adapted for general laboratory use and production test work, or as permanent components in microwave communication and radar systems where it becomes necessary to monitor the signal without disturbing or disconnecting the circuit.

When operated in conjunction with suitable accessory equipment, they are used with c-w, pulse or square-wave input signals for:

(1) Measuring absolute or relative power traveling from the signal source towards the load (incident power).

(2) Isolating or decoupling microwave components in the measurement or monitoring of signal frequency and power in the main transmission line.

(3) Attenuating input power levels by known factors. Microline precision calibrated directional couplers are suitable for use as secondary attenuation standards.

OCTOBER 1953 PUBLICATION NO. 23-1905A

SPERRY GYROSCOPE COMPANY
DIVISION OF THE SPERRY CORPORATION · EXECUTIVE OFFICES: GREAT NECK, NEW YORK
NEW YORK · LOS ANGELES · SAN FRANCISCO · NEW ORLEANS · CLEVELAND · SEATTLE

(4) Measuring receiver sensitivity with a mixer connected to the output of the secondary arm of the directional coupler.

DESCRIPTION

The Specifications on pages 5 and 6 summarize the electrical and physical characteristics of the four models, and list the connector types used with the 7/8-inch coaxial line.

The coaxial directional couplers in this group are rugged, compact instruments requiring no tuning adjustments. They are built to precise tolerances to give approximately uniform electrical performance within the frequency band covered by each particular model.

The basic design common to all models consists of two short lengths of 7/8-inch coaxial line rigidly mounted parallel to one another on either side of a symmetrical central junction piece, which is somewhat shorter than either line section. A longitudinal axial slot is located in the separating wall of the junction piece.

One coaxial section fitted with AN connectors at each end forms the main or "primary" line of the instrument. The other section is fitted with a connector at only one end following a 90-degree bend, and is designated as the auxiliary or "secondary" line. The opposite end of the auxiliary line is terminated with a matched load to absorb any power coupled from the reflected wave in the main line. A shorting plate is permanently mounted beyond the matched load at this end of the line. As an aid to proper connection of the instrument during operation, the primary line is clearly marked to indicate the required direction of the load.

In each model input signal energy is coupled from the main to the auxiliary line through the axial slot in the common junction wall. In any particular coupler model the shape of the slot varies with the frequency range and specified degree of coupling. In general the aperture width decreases with increasing attenuation, and the length decreases with increasing frequency. Compensation by means of frequency-insensitive bars on the center conductor in the region of the slot is employed to provide a satisfactory directivity characteristic. The center conductors of both lines are supported by "reflectionless" undercut beads.

GENERAL OPERATION

The directional couplers in this group are instruments designed to operate as one-way power monitors in coaxial transmission lines. These

devices are responsive to power flowing in only one direction in the main line, and couple a definite fraction of this power to the output terminal of the secondary coaxial line.

In describing the characteristics of directional couplers, there are two useful definitions. Coupling is defined as the ratio of the output power level in the secondary line to the power level in the main line and is usually expressed in decibels. The term "directivity" is the ratio of the secondary-line output power coupled from a unit wave introduced into the normal load end to that extracted from a unit wave introduced into the normal input (generator) end of the primary line, with the main transmission line perfectly terminated in each case. In the General Specifications the term "effective directivity" is used to take into account the effect of imperfect secondary-line terminations. In general, directivity is also expressed in decibels.

OPERATING PROCEDURES

1. The accuracy of directional coupler measurement of *incident-wave absolute power* is independent of the load impedance and the point of coupler insertion in the line. However, since the response of the instrument is proportional to the excitation in one direction only, it does not measure net power absorbed by the load directly unless the load impedance is exactly equal to the characteristic impedance of the line. If the load is mismatched, the indicated power will be in excess of that dissipated in the load by the ratio of the amplitude of reflected to incident power. Hence, for measurements of true power absorbed by a load, a simple determination of VSWR using an impedance meter will yield a coefficient of reflection from which net power may readily be computed.

In the measurement of relative power levels consideration of matching conditions at the load may be omitted, since power into the load is always proportional to that propagated past the directional coupler wherever it is placed.

2. Non-dissipative isolation or decoupling of microwave components - such as frequency meters or power detectors - from the main transmission line is provided by the appreciable attenuation (20 db min) between the primary and secondary lines of these instruments. Thus any disturbance introduced into the secondary line of a directional coupler by a frequency meter has minimum reaction upon the primary line of the system. Frequency pulling and power mismatch of the signal generator are greatly reduced and the waste of power inherent in dissipative isolation of a microwave component is eliminated.

3. When calibrated against primary attenuation standards, coaxial directional couplers serve as excellent *fixed-attenuation standards* since the coupling is not affected by variation in temperature or humidity. When used in this application, it is desirable to terminate the load end of the main line with a matched load. The coupling values of the instrument, as indicated on the curve furnished with each unit, then become its attenuation values at all frequencies over the range.

4. For measurement of *microwave receiver sensitivity* directional couplers are useful to reduce the power level to a value that will not overload the input stage of the receiver.

CALIBRATION

A characteristic curve of coupling in db vs frequency is provided with each coaxial directional coupler. The curve represents average values from measurements on couplers of the same model.

The actual measured coupling for each particular instrument is indicated at three frequency points on the characteristic curve. These calibration points are taken at the mid-frequency and the high and low limits of the range. Coupling at mid-frequency does not differ from the nominal value by more than 1 db, and there is less than 2 db variation over the band.

The accuracy is ±0.5 db at the measured calibration points for all the directional couplers in this group.

MAINTENANCE

Directional couplers should be kept clean and handled carefully. The entry of oil, dirt or any foreign material into either line may change the coupling and directivity characteristics and can produce excessive mismatches and high attenuation.

The contact faces of the connectors should be kept clean and free of nicks or burrs which would prevent a tight mechanical fit with mating flanges, tend to introduce leakage and adversely affect the impedance match of the joint. Dents or scratches on any inside surface of an instrument should be avoided in order to maintain optimum performance from the unit.

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Model No.	*Frequency Range (Mc)*	*Nominal Coupling (Db)*[1]
517	240 - 480	20, 30, 40
519	480 - 960	20, 30, 40
480	960 - 1,990	20, 30, 40
467	1,990 - 4,000	20, 30, 40

TRANSMISSION LINE AND CONNECTOR TYPES

Same for All Models

Coaxial Lines (Both Primary & Secondary)

AN Type. RG-92/U

Size . . . . . .7/8 x 3/8 x 0.032-Inch

Connectors

Primary Line - AN Types

Input. UG-46/U

Output UG-45/U

Secondary Line - AN Type

Output UG-45/U

PHYSICAL CHARACTERISTICS

Model No.	*Overall Size (Inches)*		
	Length	*Width*	*Height*
467	8-1/4	1-3/8	4-7/16
480	9-5/8	1-3/8	4-7/16
517	15-3/4	1-3/8	4-7/16
519	11-5/8	1-3/8	4-7/16

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[1] *Nominal Coupling:* Each of these Coaxial Directional Couplers is available with 20-, 30- and 40-db nominal coupling values. For identification purposes, a dash number corresponding to the desired coupling is added to the particular model number. For example, 517-20 refers to the 20-db coupler in the 240- to 480-mc region.

GENERAL SPECIFICATIONS (All Models)

Electrical

Coupling Variation	2 db max over entire band
Coupling at Center Frequency	Within 1 db of nominal value
Calibration Accuracy	±0.5 db at the measured calibration points from 240 to 4,000 mc
Effective Directivity	Greater than 15 db over the complete bandwidth
Maximum Coupled Power into Termination	1 watt average
Maximum VSWR	
Primary Line	1.15 from 960 to 4,000 mc
Secondary Line	1.50

Operational

Operating Temperature Range	-40° to +55° C
Humidity Effects	Negligible

Physical

Finishes	
Electrical Surfaces	High-conductivity silver plate covered by corrosion-resistant rhodium
Non-conducting Surfaces	Black enamel

SERVICE AND REPAIRS

Inquiries regarding the servicing, repair or operation of any Microline instrument should be directed to Field Service Engineering Department at the address below. Do not return any unit before making this contact.

SPERRY GYROSCOPE COMPANY
DIVISION OF THE SPERRY CORPORATION
GREAT NECK, NEW YORK

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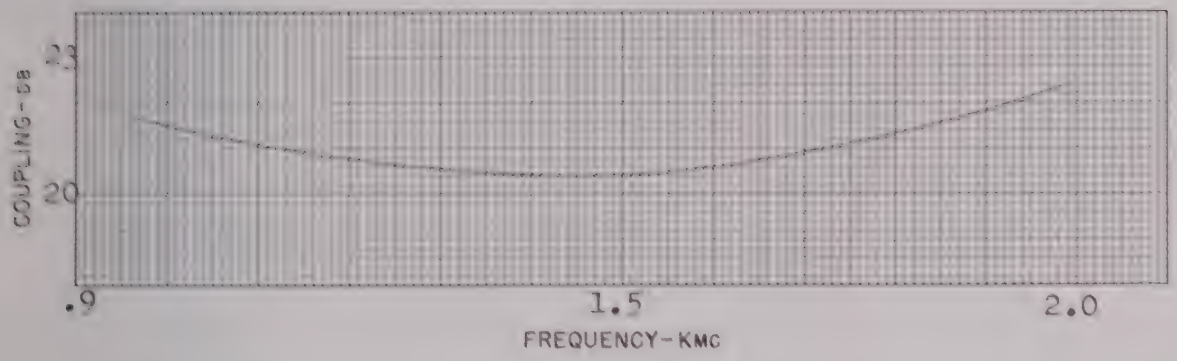
Microline®

COAXIAL DIRECTIONAL COUPLER
MODEL 480-20 SERIAL #71

COUPLING VS FREQUENCY



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MODEL 480-20 SERIAL #71

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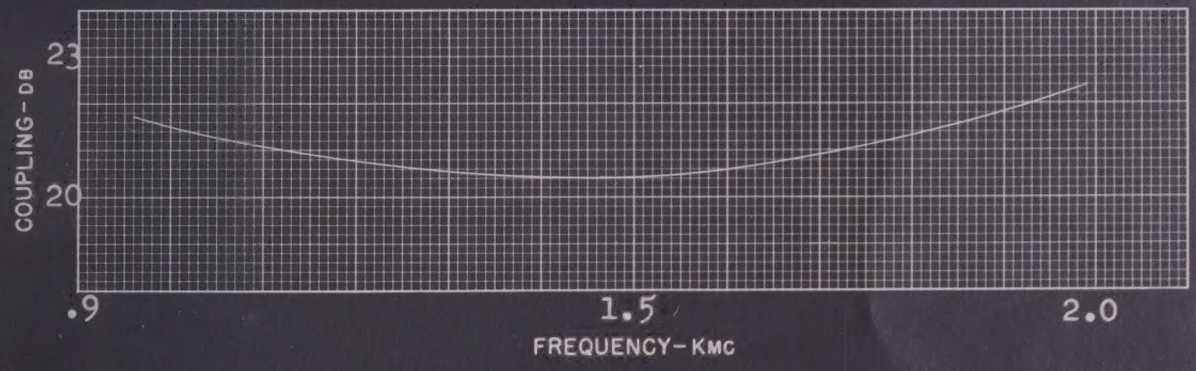

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